Comparison of the Performance of Two Plug-Flow Digesters for Dairy Cattle Manure

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Gordondale Farms

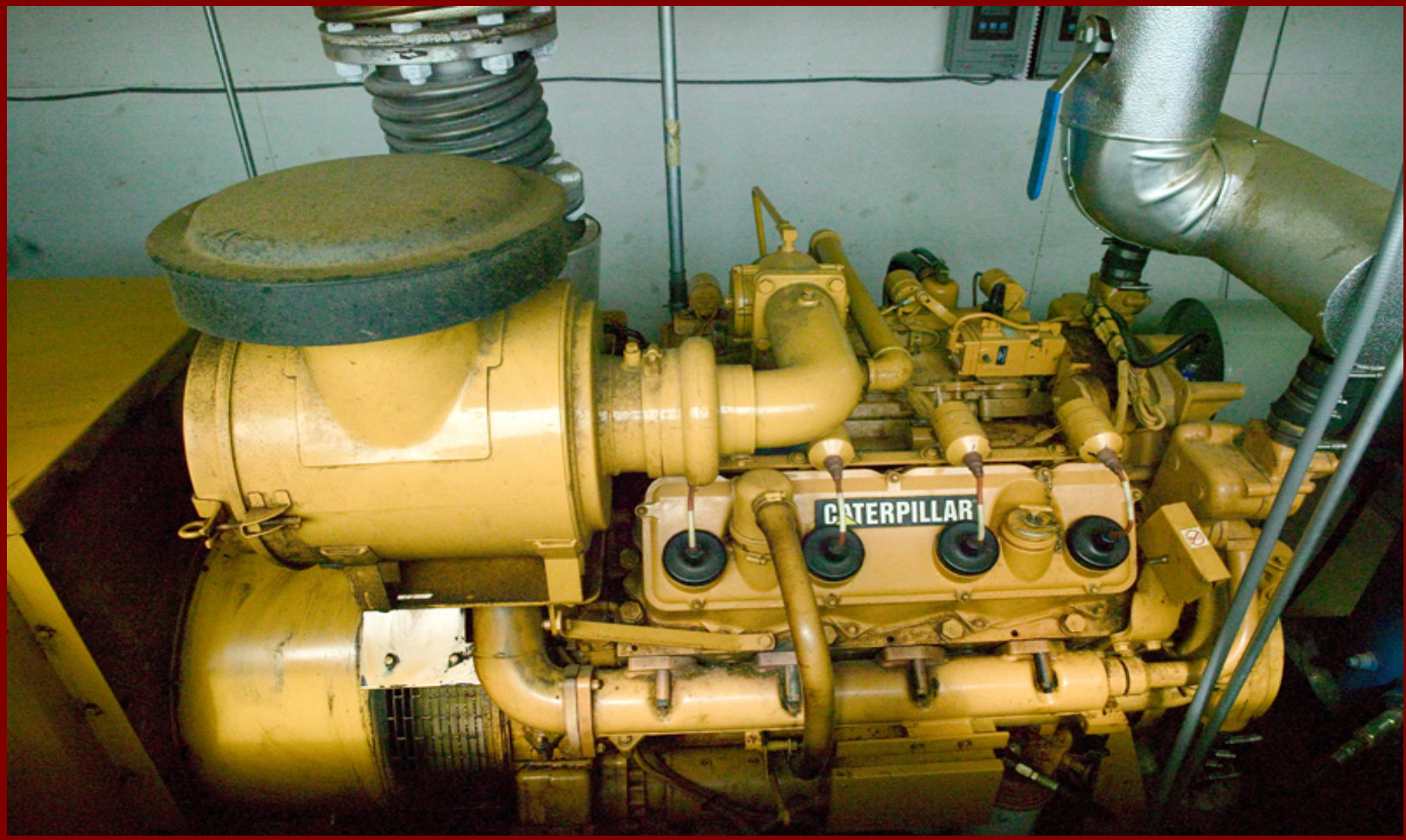
- Farm details
  - 3,200 acres
  - Located in Nelsonville, WI
  - Milking herd size during the study: 750 to 860 cows
  - Naturally ventilated free-stall housing with scraped alleys
  - Milking center wastewater combined with scraped free-stall barn manure

Gordondale Farms (continued)

- Digester details
  - Two-stage modified plug-flow with vertical gas mixing and a rigid cover
  - Designed and constructed by GHD, Inc., Chilton, WI
  - Design milking herd size: 750 cows
  - Biogas used to generate electricity (Cat 3406) with waste heat recovery for digester heating and water and space heating

Gordondale Plug-Flow Digester

Gordondale Engine-Generator Set



AA Dairy

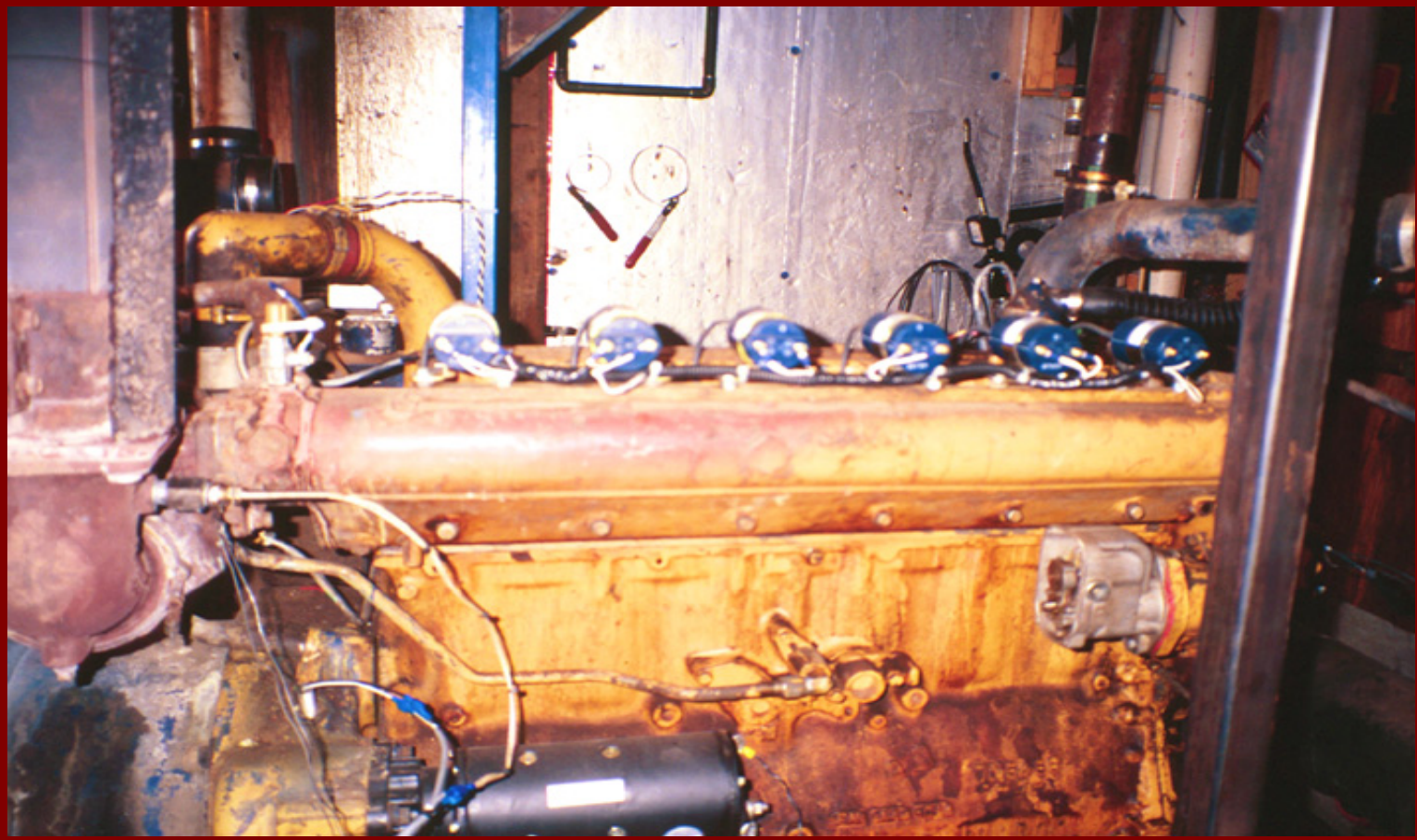
- Farm Details
  - 2,200 acres
  - Located in Candor, NY
  - Milking herd size during the study: 550 cows
  - Naturally ventilated free-stall housing with scraped alleys
  - Milking center wastewater discharged directly to the digester effluent storage pond

AA Dairy (continued)

- Digester details
  - Conventional plug-flow with a flexible cover
  - Designed and constructed by RCM Digesters, Inc., Berkley, CA
  - Design milking herd size: 1,054 cows
  - Biogas used to generate electricity (Cat 3406) with waste heat recovery only for digester heating

AA Dairy Plug-Flow Digester

AA Dairy Engine-Generator Set



Waste Stabilization

Reduction, %	Gordondale	AA Dairy
TS	35.4	25.1
TVS	39.6	29.7
FS	31.3	—
COD	38.5	41.9
TVA	87.8	86.1
TN	—	—
NH_4-N	+24.9	+33.4
TP	—	—

TVS Biodegradability

- Gordondale Farms—47 %
- AA Dairy—30 %

Indicator Organism & Pathogen Reductions, $\log_{10}$

Microorganism	Gordondale	AA Dairy
Fecal Coliforms	2.3 (>99 %)	2.8 (~99.9 %)
Fecal Streptococcus	1.3 (>90 %)	—
M. Avium paratuberculosis	—	2.1 (>99 %)

Biogas Composition

	Gordondale	AA Dairy
CH_4	55.9 %	59.1 %
CO_2	43.8 %	39.2%
H_2S	3,100 ppm	1,930 ppm
NH_3	35 ppm	15 ppm

Biogas Production & Utilization

	Gordondale	AA Dairy
Biogas production, ft^3/cow-day	109	78
Electricity generated, kWh/cow-day	3.86	2.60
Thermal efficiency, %	21	20

Economics

	Gordondale	AA Dairy
Capital cost (as built)	$550,000 (w/o generator set @ $198,000)	$245,200
Cost per cow	$640	$446
Income from electricity	$18,396/yr @ $0.015/kWh	$32,785/yr @ $0.105/kWh
Income from separated solids	$68,600/yr	$29,200

Acknowledgements

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Thank-you!

Questions?